

# Improving Medical Calculation Skills for Graduated Nurses with E-learning in Hospitals

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**Abstract**— Medical calculation is a core competence for nurses. During their study period this subject is trained intensively. Research showed however that 40% of the nurses, already graduated for several years, can't calculate accurately (Medinews, 2007). Some hospitals argue that the basic medical calculation competences of new graduated nurses are already too low. Research question is how can e-learning improve the medical calculation skills for nurses?

A 3 year project was financed by the Flemish Government to research if it is possible to develop an e-learning platform for in-service nurses to improve their medical calculation skills through learning in the workplace, using an e-learning platform.

A moodle-server was setup. Tests were made to measure nurses basic calculation skills. Also some courses, used in the regular education of nurses, were uploaded in the Virtual Learning Environment (VLE). The pilot group counted five hospitals. First results of the tests showed that the basic calculation skills are effectively too low. Even in hospitals where the results of the first tests were relatively low, we saw that other nurses even didn't do the test. Also a result was that doing the test is scaring for nurses. They are concerned about the negative influence, in case of bad results.

Extra courses, as a kind of lifelong learning course, for medical calculation seems necessary. Digital courseware is developed and offered online. Nurses can during the work-time improve their skills and do new tests until the medical calculation skills have reached an acceptable level.

Managers in the hospitals are asking now for a structural solution. They want to test applicants with the same tests and exercises before they can start working in hospitals. A lifelong learning program will be developed for medical calculation.

**Index Terms**— Digital courseware, E-Learning, Lifelong Learning, Medical calculation competences, Virtual Learning Environment (VLE).

## I. INTRODUCTION

Every university and university college has a lot of knowledge. However a lot of knowledge is missed by employees in companies and organizations. An example is the medical calculation skills of in-service nurses. Fourty percent of the nurses scores insufficient on medical calculation tests. Thirty percent of the nurses says to have made already a calculation mistake in nursing medicaments (Medinews, 2007). The core question is how can the knowledge in universities help nurses to ameliorate their calculation skills, especially when they are already graduated?

## II. POSSIBLE SOLUTIONS

### A. Basic Knowledge

All the knowledge – needed by in-service nurses – is present in every university or university College. After all the content is used in the regular higher education for nurses. An attempt is made to digitalize the medical calculation content and publish it in the (VLE). It is a small step to open this content and make it available for nurses in hospitals.

During the 3 year research project a moodle-server was set up and the content was made available. Five hospitals and nursing institutions were selected to test the content. The content was set up in tests as in Moodle is built in. It certainly was not the goal to try to get some insights in the medical calculation skills of nurses, but to help them to ameliorate their skills. It was made clearly to all the participants that the results of the tests would not be used for statistical goals or to approve earlier studies about the failing medical calculation skills. The main goal was to ameliorate the skills of the nurses. For that reason this paper doesn't mention nor the group nor the individual results that nurses made.

### B. Selected content

During this research the content was limited to some domains. Fourty questions were divided into four groups. Each group only had ten questions. Reason for working in small tests was the limited time that nurses could spent at the workplace for doing the test. The highest score was 75% and the lowest score was 51%.

 **Bron: Grootheden en eenheden**

3 keren bekeken - meest recente Tuesday, 3 November 2009, 18:40

 **Test: Verdunnen**

Cijfer: 6/10

Poging 1: 6/10 - Tuesday, 3 November 2009, 18:41

**Figure 1: learning style**

In this figure the VLE reported that the nurse consulted 3 times the e-learning course before doing the test. Even with this consultation the score was 6/10. This proves that just consulting the information, followed by the test doesn't solve the problem of insufficient medical calculation skills.

The tests also showed a great difference between the several content-chapters in medical calculation. One of the most extreme results were the following:

**Rapport - ZMKo6 ZMKo6**

Cijferitem	Categorie	Cijfer	Procent	Feedback
Verdunnen	Medisch Rekenen	6,00	60,00 %	
Zuurstof	Medisch Rekenen	6,25	62,50 %	
Percenten	Medisch Rekenen	7,00	70,00 %	
Debiet	Medisch Rekenen	2,35	23,50 %	
Complexe berekeningen	Medisch Rekenen	0,00	0,00 %	
Gecombineerde oefeningen	Medisch Rekenen	9,00	90,00 %	
<b>Aggregatie Cursustotaal</b>	<b>Medisch Rekenen</b>	<b>51,00</b>	<b>51,00 %</b>	

**Figure 2: an individual report**

This nurse scored an average of 51%, but this doesn't say enough. The test about combined exercises scored 90%. The test about medical calculation (subject flow) scored only 23,50% and remarkable is that the next test was not made (score 0%). This test learned us that the medical calculation skills of a nurse that scored 51% can't be used for taking conclusions about the medical calculation skills at all. Some parts are definitely good, while other parts are really a problem.

**C. Using Moodle**

Using the internet is not always easy in Belgian hospitals. Due to the privacy aspects and the 'delicate' information about patients, computers in hospitals have no automatic internet access or access to other resources then the network that is used for registering patient-information. For that reason some nurses had to study at home. Others had to ask – some days before – to have access to the internet at work in their hospital.

All the questions were formulated in multiple choice questions and automated correction, with the main goal to inform the nurses as soon as possible about their results. A positive consequence was that the nurses felt as the computer gave the score, not the teachers. Also the number of questions was limited, so that the tests could be made during the working time. A long test would have had as advantage that the exact knowledge could be measured better, but the disadvantage would be that nurses simply wouldn't have enough time to fill in the questions accurately.

**D. The mental or psychological aspects**

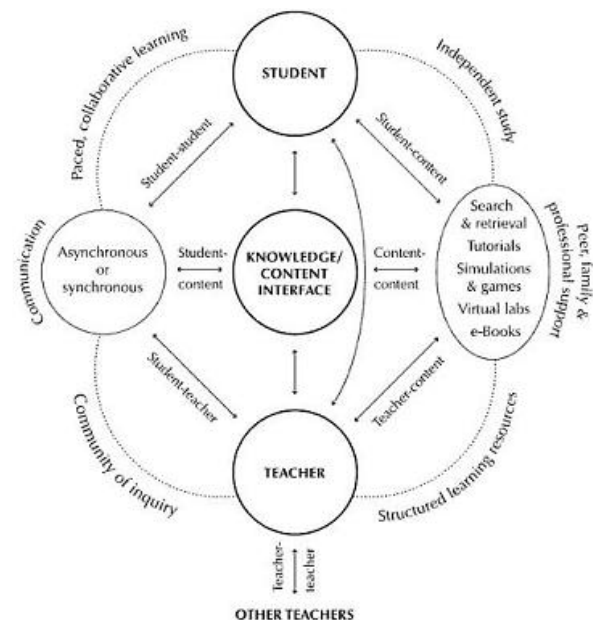
During the test-phase it became very soon clear that what is detected as a general problem is not seen as the same problem by individual nurses. Indeed, a nurse that makes a medical calculation mistake is mostly not aware of it. One major consequence is that the need for an update about the medical calculation skills is not found useful for them individually. The managers of hospitals wants to solve the problem of the failing medical calculation skills that are reported in studies (Medinews, 2007).

Due to the fact that the results of the test are shown immediately after the test, the impact of the results, especially the negative results, was more important than was thought. In one hospital where the first nurse did the test (with an negative result), no other nurses did the tests anymore. This means that there was communication between the nurses. This is not necessarily negative. However there was some fear that the test-results would influence their personal file. Some adjustments have to be

made: it is important to get an overview of the medical calculation skills of nurses, but certainly not in a way that they feel threatened about the results. Secondly and maybe even more important is that a general course offers more added value for the learning path of the nurses. By starting with a course, there already has been some attempts to ameliorate the first testing results. Starting from a test and then try to offer a personalized learning traject can be felt as a threat for nurses.

**E. Blended Learning**

A blended learning strategy seems to be necessary to solve the problem. A combination of schooling, testing and peer-to-peer communication can help the nurses. This is probably not the shortest way to solve the problem, but avoids that nurses get a negative feeling about their medical calculation skills and drop out earlier. Although there are a lot of learning models, the model of online learning (Anderson, 2008) is a very good model for implementation, because of the variety of possibilities to deal with the content of medical calculation. This model sees 'blended learning' more than the most models that use 'blended' for the combination of online and off-line teaching. It is the 'blended' way that offers nurses the possibility to learn, that is essential.

**Figure 3 Anderson T., The Theory and Practice of Online Learning, p. 61**

This model of online learning offers a lot of possibilities for effective lifelong learning:

- The content, i.e. the knowledge about medical calculation, is the core-component. The content is offered in different ways: offline as a traditional course, but also online in different ways: as digitalized text, as exercises, as tests with automated correction in the VLE.
- The communication, about the content, can be realized through different ways: through a rather traditional way (teacher – student) or via alternative ways (student – student or student – content).

This means that lifelong learning for nurses will have certain alternatives that don't exclude one another. Traditional lessons can be combined with online tests, self-directed studies and, peer-to-peer support. In this way, the most suited learning style for all nurses can be used. Ameliorating the calculation skills is the main goal, not the way it can be realized.

When this model is set up, it is important to give the necessary attention to the communication. Gilly Salmon did research on this topic and formulated the 5 steps model to support learners online. Only offering content doesn't lead necessary to learning.

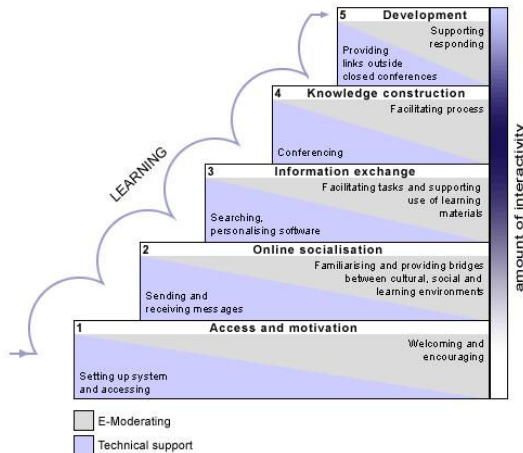


Figure 4: the 5 stage model

Salmon (2004) showed that offering online information is not enough. Learning is a complex process and takes place through the five formulated steps of the model. We suggest that the online learning model of Anderson should be combined with e-moderators, that are really aware of the importance of their role in supporting nurses to grow in their medical calculation skills.

#### F. Regular students

Due to the importance of the subject, it is to advice that the regular higher education teachers should be aware of the possibilities that are offered to in-service nurses. We suggest that students from the beginning of their education at the age of 18-years should be introduced in this way of learning medical calculation. Main goal is to integrate a lifelong learning attitude for medical calculation. Regular nursing schooling at university colleges and hospitals are advised to work together to save costs in the development of the course materials. Having medical calculation skills should be learned and maintained a lifelong.

### III. CONCLUSIONS

Medical calculation skills are core competences for nurses. Too many nurses don't have enough medical calculation skills, especially when they were graduated a certain period ago. Managers in hospitals are aware of the problem and want to solve the problem. Nurses are often not aware of the problem and therefore don't see the need for a continuing schooling. However confronted with tests nurses are more interested in hiding the results than take

measures to ameliorate the skills. The research showed that the shortest learning track, namely doing an online test and trying to detect the problem, followed by an effective schooling is not always the best solution. Nurses are very much concerned about the way the test-results can influence their personal file. Offering different solutions, as the model for online learning describes, gives nurses the choice, related most to their personal learning style. Although the VLE contained some course materials, some nurses used them, others didn't. An effective way to use effectively the online learning materials needs an e-moderator. The e-moderator has to be aware of the 5-stage model of Salmon and needs the skills to motivate nurses to learn in an effective way. One of the most important results of this research is that 'medical calculation skills' is not exact enough. Really important is the fact that within the medical calculation skills a nurse can have excellent skills for one group of exercises, but complete the opposite for the other group. The example of one nurse, that scored an average of 51%, but also 90% and 23,50% for different sub-groups is significant. We recommend that university colleges and hospitals should work together to set up a collaboration for the development of the course materials and the lifelong learning.

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